



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 4, 2011

Site Vice President
Entergy Nuclear Operations, Inc.
Vermont Yankee Nuclear Power Station
P.O. Box 250
Governor Hunt Road
Vernon, VT 05354

**SUBJECT: VERMONT YANKEE NUCLEAR POWER STATION - ISSUANCE OF
AMENDMENT RE: REVISED REACTOR VESSEL PRESSURE-
TEMPERATURE LIMITATION CURVES (TAC NO. ME5252)**

Dear Sir or Madam:

The Commission has issued the enclosed Amendment No. 250 to Renewed Facility Operating License DPR-28 for the Vermont Yankee Nuclear Power Station, in response to your application dated December 21, 2010, as supplemented by letter dated May 16, 2011.

The proposed amendment would revise Technical Specifications Section 3.6.A "Pressure and Temperature Limitation" to reflect the pressure and temperature limits for the reactor coolant system through, approximately the end of the prospective 20-year renewed license period, depending on the plant capacity factor.

A copy of the related Safety Evaluation is also enclosed. Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

A handwritten signature in black ink that reads "James Kim".

James Kim, Project Manager
Plant Licensing Branch 1-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-271

Enclosures:

1. Amendment No. 250 to License No. DPR-28
2. Safety Evaluation

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

ENTERGY NUCLEAR VERMONT YANKEE, LLC

AND ENTERGY NUCLEAR OPERATIONS, INC.

DOCKET NO. 50-271

VERMONT YANKEE NUCLEAR POWER STATION

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 250
License No. DPR-28

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment filed by Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc. (the licensee) dated December 21, 2010, as supplemented by letter dated May 16, 2011, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;
 - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
 - C. There is reasonable assurance: (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
 - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
 - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended as indicated in the attachment to this license amendment, and paragraph 3.B of the Renewed Facility Operating License No. DPR-28 is hereby amended to read as follows:

(B) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 250, are hereby incorporated in the license. Entergy Nuclear Operations, Inc. shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented within 60 days.

FOR THE NUCLEAR REGULATORY COMMISSION



Nancy L. Salgado, Chief
Plant Licensing Branch 1-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the License and
Technical Specifications

Date of Issuance: November 4, 2011

ATTACHMENT TO LICENSE AMENDMENT NO. 250
RENEWED FACILITY OPERATING LICENSE NO. DPR-28
DOCKET NO. 50-271

Replace the following page of the Renewed Facility Operating License with the attached revised page. The revised page is identified by amendment number and contains marginal lines indicating the areas of change.

Remove
3

Insert
3

Replace the following pages of the Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contains marginal lines indicating the areas of change.

Remove
135
136
137
138

Insert
135
136
137
138

- D. Entergy Nuclear Operations, Inc., pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess, and use in amounts as required any Byproduct, source, or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components.
 - E. Entergy Nuclear Operations, Inc., pursuant to the Act and 10 CFR Parts 30 and 70, to possess, but not to separate, such byproduct and special nuclear material as may be produced by operation of the facility.
3. This renewed license shall be deemed to contain and is subject to the conditions specified in the following Commission regulations: 10 CFR Part 20, Section 30.34 of 10 CFR Part 30, Section 40.41 of 10 CFR Part 40, Section 50.54 and 50.59 of 10 CFR Part 50, and Section 70.32 of 10 CFR Part 70; and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified below:

A. Maximum Power Level

Entergy Nuclear Operations, Inc. is authorized to operate the facility at reactor core power levels not to exceed 1912 megawatts thermal in accordance with the Technical Specifications (Appendix A) appended hereto.

B. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 250 are hereby incorporated in the license. Entergy Nuclear Operations, Inc. shall operate the facility in accordance with the Technical Specifications.

C. Reports

Entergy Nuclear Operations, Inc. shall make reports in accordance with the requirements of the Technical Specifications.

D. This paragraph deleted by Amendment No. 226.

E. Environmental Conditions

Pursuant to the Initial Decision of the presiding Atomic Safety and Licensing Board issued February 27, 1973, the following conditions for the protection of the environment are incorporated herein:

- 1. This paragraph deleted by Amendment No. 206, October 22, 2001.
- 2. This paragraph deleted by Amendment 131, 10/07/91.

Figure 3.6.1

**Reactor Vessel Pressure-Temperature Limitations
Hydrostatic Pressure and Leak Tests, Core Not Critical**

**40°F/hr Heatup/Cooldown Limit
Valid Through 7.943'E8 MWH(t)**

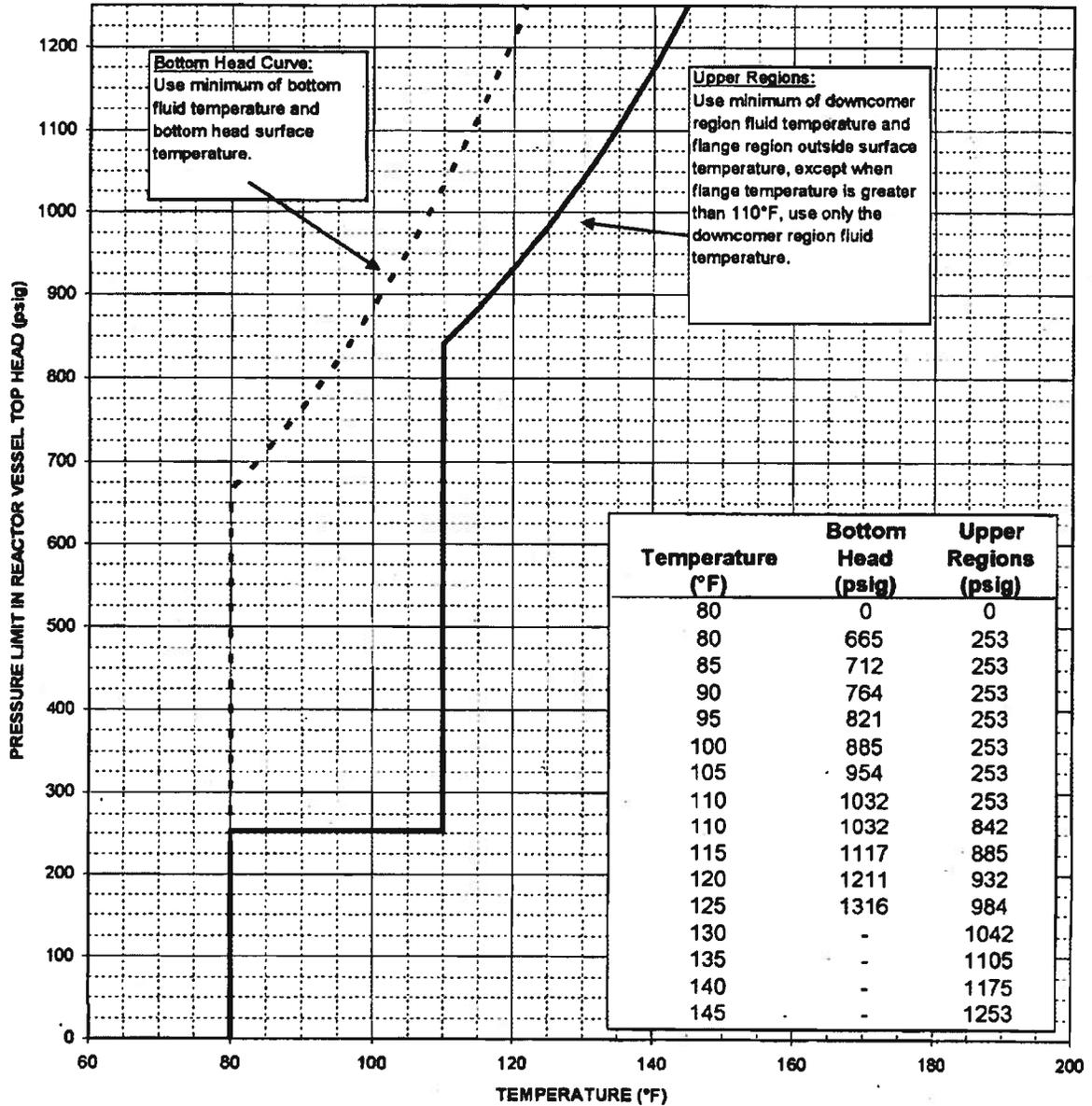


Figure 3.6.2

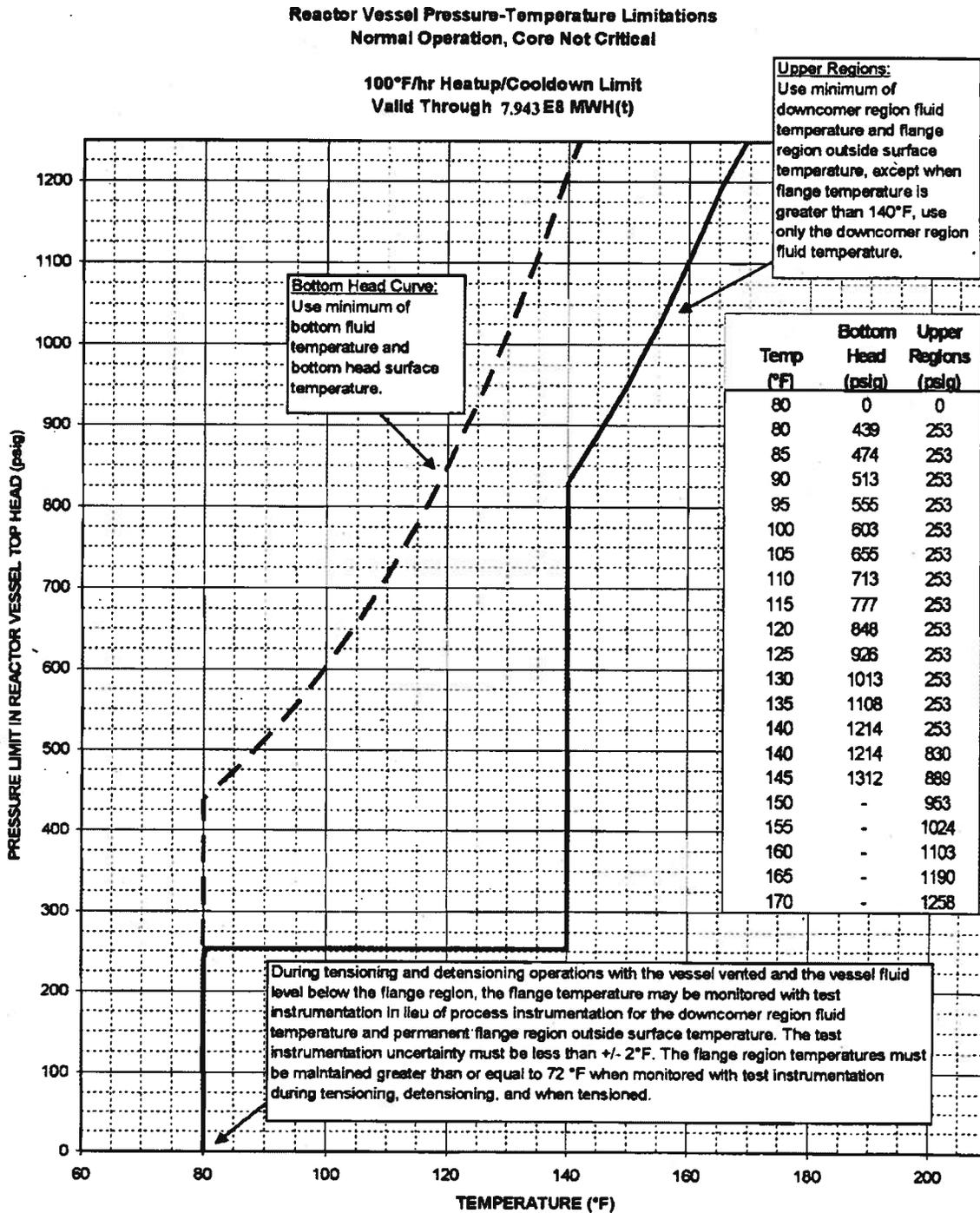
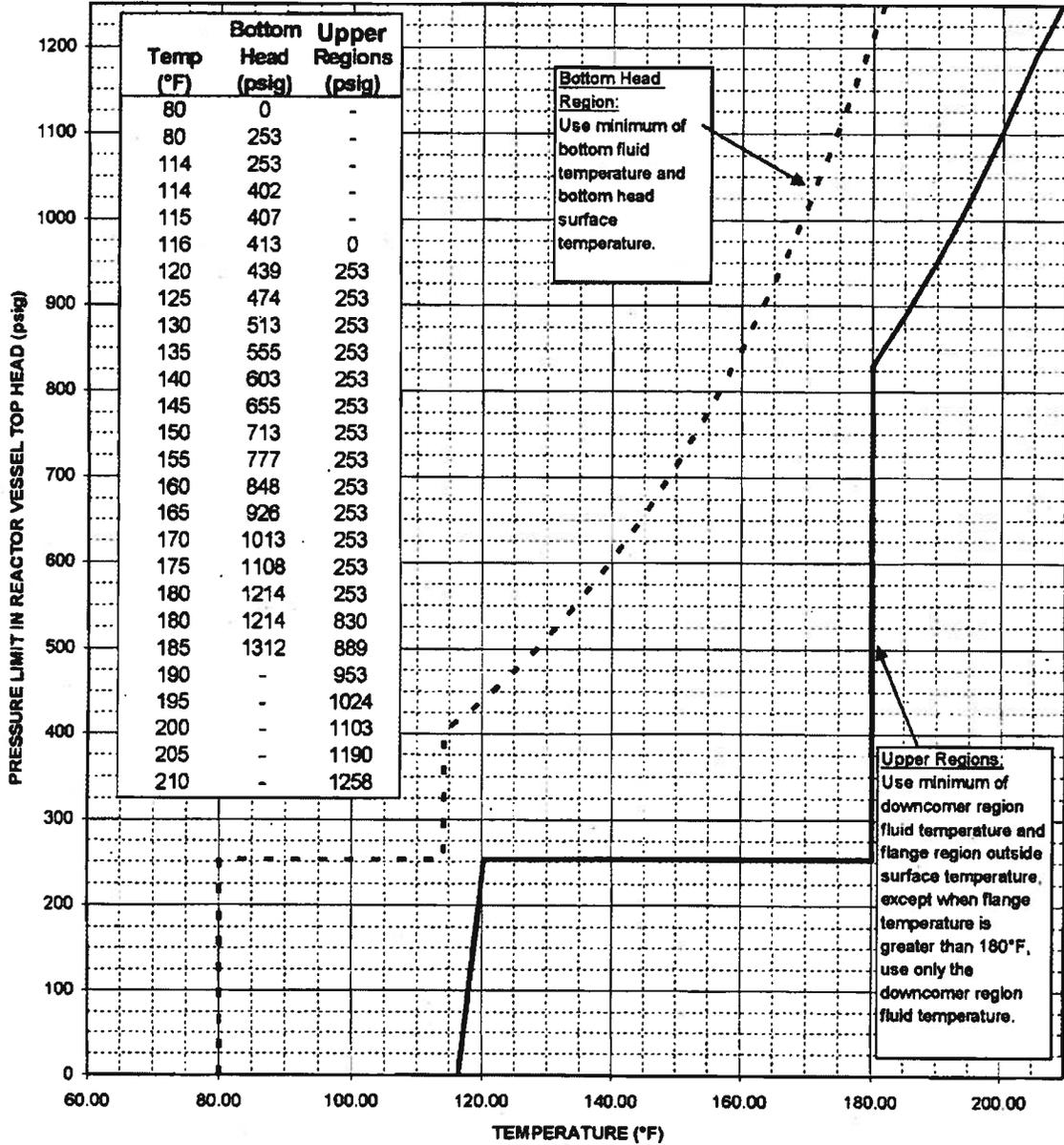


Figure 3.6.3

**Reactor Vessel Pressure-Temperature Limitations
Normal Operation, Core Critical**

**100°F/hr Heatup/Cooldown Limit
If Pressure < 253 psig, Water Level must be within
Normal Range for Power Operation
Valid Through 7.943 E8 MWH(t)**



BASES:3.6 and 4.6 REACTOR COOLANT SYSTEMA. Pressure and Temperature Limitations

All components in the Reactor Coolant System are designed to withstand the effects of cyclic loads due to system temperature and pressure changes. These cyclic loads are introduced by normal load transients, reactor trips, and startup and shutdown operations. The various categories of load cycles used for design purposes are provided in Section 4.2 of the FSAR. During startup and shutdown, the rates of temperature and pressure changes are limited so that the maximum specified heatup and cooldown rates are consistent with the design assumptions and satisfy the stress limits for cyclic operation.

The Pressure/Temperature (P/T) curves included as Figures 3.6.1, 3.6.2, and 3.6.3 were developed using 10CFR50 Appendix G, 1995 ASME Code, Section XI, Appendix G (including the Summer 1996 Addenda), and ASME Code Case N-640. These three curves provide P/T limit requirements for Pressure Test, Core Not Critical, and Core Critical. The P/T curves are not derived from Design Basis Accident analysis. They are prescribed to avoid encountering pressure, temperature or temperature rate of change conditions that might cause undetected flaws to propagate and cause nonductile failure of the reactor pressure boundary, a condition that is unanalyzed.

During heating events, the thermal gradients in the reactor vessel wall produce thermal stresses that vary from compressive at the inner wall to tensile at the outer wall. During cooling events the thermal stresses vary from tensile at the inner wall to compressive at the outer wall. The thermally induced tensile stresses are additive to the pressure induced tensile stresses. In the flange region, bolt preload has a significant affect on stress in the flange and adjacent plates. Therefore heating/cooling events and bolt preload are used in the determination of the pressure-temperature limitations for the vessel.

The guidance of Branch Technical Position - MTEB 5-2, material drop weight, and Charpy impact test results were used to determine a reference nil-ductility temperature (RT_{NDT}) for all pressure boundary components. For the plates and welds adjacent to the core, fast neutron ($E > 1$ Mev) irradiation will cause an increase in the RT_{NDT} . For these plates and welds an adjusted RT_{NDT} (ART_{NDT}) of 89°F and 73°F ($\frac{1}{4}$ and $\frac{3}{4}$ thickness locations) was conservatively used in development of these curves for core region components. Based upon plate and weld chemistry, initial RT_{NDT} values, predicted peak fast neutron fluence (5.16×10^{17} n/cm² at the reactor vessel inside surface) for a gross power generation of 7.943×10^8 MWH(t), these core region ART_{NDT} values conservatively bound the guidance of Regulatory Guide 1.99, Revision 2.

There were five regions of the reactor pressure vessel (RPV) that were evaluated in the development of the P/T Limit curves: (1) the reactor vessel beltline region, (2) the bottom head region, (3) the feedwater nozzle, (4) the recirculation inlet nozzle, and (5) the upper vessel flange region. These regions will bound all other regions in the vessel with respect to considerations for brittle fracture.

Two lines are shown on each P/T limit figure. The dashed line is the Bottom Head Curve. This is applicable to the bottom head area only and includes the bottom head knuckle plates and dollar plates. Based on bottom head fluid temperature and bottom head surface temperature, the reactor pressure shall be maintained below the dashed line at all times.



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WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 250 TO

RENEWED FACILITY OPERATING LICENSE NO. DPR-28

ENTERGY NUCLEAR VERMONT YANKEE, LLC

AND ENTERGY NUCLEAR OPERATIONS, INC.

VERMONT YANKEE NUCLEAR POWER STATION

DOCKET NO. 50-271

1.0 INTRODUCTION

By letter dated December 21, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML103630446), as supplemented by letter dated May 16, 2011 (ML11140A083), Entergy Nuclear Operations, Inc. (the licensee) submitted a request to amend the Vermont Yankee Nuclear Power Station (VY) Technical Specifications (TS). The amendment would revise TS Section 3.6.A "Pressure and Temperature Limitation" to reflect the pressure and temperature (P-T) limits for the reactor coolant system through, approximately the end of the prospective 20-year renewed license period, depending on the plant capacity factor.

The supplemental letter dated May 16, 2011, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the Nuclear Regulatory Commission (NRC) staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on February 22, 2011 (76 FR 9823).

2.0 REGULATORY EVALUATION

The NRC has established requirements in Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 50) to protect the integrity of the reactor coolant pressure boundary in nuclear power plants. The staff evaluates the acceptability of a facility's proposed P-T limit curves based on the following NRC regulations and guidance: Appendix G, "Fracture Toughness Requirements," to 10 CFR Part 50; Appendix H, "Reactor Vessel Material Surveillance Program Requirements," to 10 CFR Part 50; Regulatory Guide (RG) 1.99, Revision 2 (Rev. 2), "Radiation Embrittlement of Reactor Vessel Materials;" and RG 1.190, Revision 0, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence." Appendix G to 10 CFR Part 50 requires that facility P-T limits for the reactor pressure vessel (RPV) be at least as conservative as those obtained by applying the linear elastic fracture mechanics methodology of Appendix G to Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code). Appendix H to 10 CFR Part 50 establishes requirements related to

facility RPV material surveillance programs. RG 1.99, Revision 2, contains methodologies for determining the increase in transition temperature (adjusted reference temperature, or ART) and the decrease in upper-shelf energy (USE) resulting from neutron radiation. RG 1.190, Revision 0, contains methodologies for calculating neutron fluence.

3.0 TECHNICAL EVALUATION

3.1 Licensee Evaluation

The licensee states that the P-T limit curves for TS figures 3.6.1-3 were accepted through VY License Amendment Request (LAR) No. 218, "Vermont Yankee Nuclear Power Station - Issuance of Amendment Re: Reactor Pressure Vessel Fracture Toughness and Material Surveillance Requirements (TAC Nos. MB8119 and MB8379)," dated March 29, 2004 (ADAMS Accession No. ML040620036). These curves were based on NRC requirements found in RG 1.190 and RG 1.99, Revision 2. The applicability of these curves was shown to be valid up to 4.46×10^8 MWH(t). The P-T limit curves were updated in 2006 through LAR No. 229, "Vermont Yankee Nuclear Power Station - Issuance of Amendment Re: Extended Power Uprate (TAC Nos. MC0761)," dated March 2, 2006 (ADAMS Accession No. ML06005005). This update raised the validity ceiling to 4.827×10^8 MWH(t).

The licensee highlighted in the discussion of LAR No. 229 regarding the NRC staff safety evaluation (SE) it was noted that VY made a highly conservative assumption in their P-T limit analysis. Specifically, the ART values used in the P-T limit analysis were from an earlier and highly conservative analysis. An independent NRC staff evaluation of VY ART values found that the P-T limits approved through LAR No. 229 were bounded through a 1/4T neutron fluence of 1.24×10^{18} n/cm².

The licensee proposes updating the bounding run-time to 7.943×10^8 MWH(t), corresponding to a bounding 1/4T neutron fluence of 1.24×10^{18} n/cm², while the licensee predicts that the RPV will only reach a 1/4T neutron fluence of 5.39×10^{17} n/cm² by the end of a 20-year license renewal (LR) period (for a total of 60 years of licensed operation). This update would support operations into the LR period beyond the original 40-year operating license.

The licensee states that in the LR application SE, the NRC staff concluded that the original P-T limits calculation would remain bounding for the license renewal period. Hence, the licensee proposes updating the maximum MWH(t) value and neutron fluence prediction in the TS.

3.2 NRC Staff Evaluation

The NRC staff reviewed the VY submittal and the staff SEs concerning LAR Nos. 218 and 229, in addition to the SE concerning the LR, NUREG-1907 Vol. 2 (ADAMS Accession No. ML081430109). Due to the substantial, thorough, and independent checks, already conducted in the LR review concerning the proposed new neutron fluence limit, the staff accepts the proposed update. The staff SE concerning the LR specifically noted that P-T limits must be updated prior to entering the LR period. The submittal evaluated here fulfills that expectation.

The staff notes that the licensee states, on page 4 of Attachment 1 to the submittal, that the 1/4T neutron fluence predicted for the end of 60 years of operation is 5.39×10^{17} n/cm², yet the proposed change to the text of the TS lists a predicted peak neutron fluence of 1/4T 5.16×10^{17} n/cm². The licensee acknowledged this discrepancy and will correct it when updating the TS.

The licensee noted one further change to the P-T limits, namely that Table 3.6.3 contains a title of "All Regions" that should more properly be "Upper Regions." This alteration is appropriate as the original title was in error.

The staff has concluded that the proposed changes are consistent with the intent and requirements of the applicable regulations and guidance found in Appendix G and H to 10 CFR Part 50; as well as RG 1.99, Revision 2, and RG 1.190, Revision 0.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Vermont State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in amounts, and no significant change in the types of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (76 FR 9823). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: D. Widrevitz

Date: November 4, 2011

November 4, 2011

Site Vice President
Entergy Nuclear Operations, Inc.
Vermont Yankee Nuclear Power Station
P.O. Box 250
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Vernon, VT 05354

SUBJECT: VERMONT YANKEE NUCLEAR POWER STATION - ISSUANCE OF
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TEMPERATURE LIMITATION CURVES (TAC NO. ME5252)

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Sincerely,

/ra/

James Kim, Project Manager
Plant Licensing Branch 1-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-271

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2. Safety Evaluation

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*See memo dated September 30, 2011

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